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(71) Applicant *(for all designated States except US)*: NOKIA NETWORKS OY [FI/FI]; P.O. Box 300, FIN–00045 Nokia Group (FI).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: RAJANIEMI, Jaakko [FI/FI]; Lapinrinne 2 A 11, FIN–00180 Helsinki (FI).

(74) Agent: BERGGREN OY AB; P.O. Box 16, FIN–00101 Helsinki (FI).

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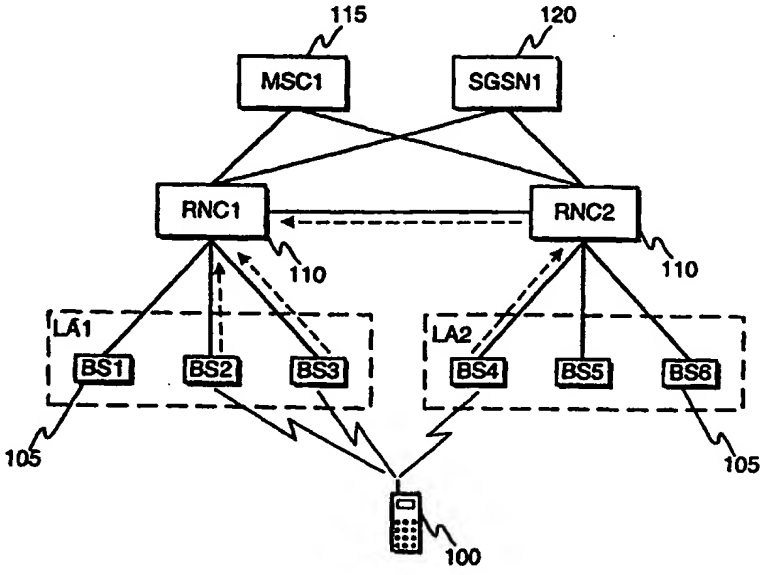

(57) Abstract

The invention is directed to a method for location management in cellular telecommunication systems. In the inventive method, priority levels are assigned to the cells of the active set of a macro diversity connection. There can be two or more different priority levels. A two–level priority scheme can be realised by further classifying the cells in the active set as being in a serving cell set or outside of the serving cell set. The serving cell set comprises cells, which are in the active set and which are under control of the serving RNC. One of the cells of the serving cell set is selected to be a master cell, which defines the location of the mobile station. More than two priority levels can also be used.

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Location management method

TECHNICAL FIELD OF THE INVENTION

The invention is directed to a method for location management in cellular telecommunication systems. More precisely, the invention is directed to a method as described in the preamble of the independent method claim.

BACKGROUND OF THE INVENTION

Macro diversity combining refers to a situation, in which a mobile station divides one signal to more than one radio connections to more than one base stations, and the network combines the received signals to produce the original signal. Macro diversity combining is advantageous especially in cellular systems, which utilise spread spectrum technology. In spread spectrum systems, many radio transmissions use simultaneously the same frequencies, whereby the total of all other transmissions is observed as background interference by a single connection. As a consequence the minimising of transmission power of mobile stations and base stations is very important. The advantage of macro diversity combining is that the total transmission power of the partial connections of a macro diversity connection is generally less than the transmission power required, if the same connection were realised using only one radio connection to one base station. This is the case especially when a mobile station is near the border of a cell, i.e. when none of the base stations are very near the mobile station, but more than one base stations are at roughly similar distances. Macro diversity combining will be used for example in the UMTS (Universal Mobile Telecommunications System) system presently under development.

Figure 1 illustrates an example of a macro diversity connection in the UMTS system. A mobile station (MS) 100 has simultaneous radio connections to two base stations 105. Base stations 105 are controlled by radio network controllers RNC1 and RNC2 110. Radio network controllers RNC1, RNC2 are in turn controlled by core network elements such as mobile services switching centres (MSC) 115 which control circuit switched connections and Serving GPRS Support Nodes (SGSN) which control packet switched connections. The interface between a core network (CN) and a radio access network (RAN) i.e. between a MSC and a RNC or a SGSN and a RNC is called the Iu interface (Interface UMTS). The interface between two

radio network controllers is called the Iur interface. Figure 1 further shows two location areas LA1, LA2. A location area (LA) covers a plurality of cells under control of a single MSC.

As figure 1 shows, the connections of the MS 100 pass through two radio network controllers RNC1, RNC2. One of these is a so called drift RNC which merely passes all signalling through the Iur interface to the main RNC, which is called the serving RNC (SRNC). The serving RNC performs, among other duties, the actual macro diversity combining.

In the present GSM system, the location management is based on a cell identifier and the location area. In the GPRS system, a location area further comprises one or more routing areas (RA). Correspondingly, the location of a mobile station can be specified unambiguously with a cell identifier and a location area identifier, and in GPRS, further with a routing area identifier. However, in the UMTS system this approach presents several problems. For example, in the example of figure 1 the mobile station has connections to two cells in different location areas, whereby the determination of the location is not as straightforward as in the conventional GSM system. Therefore, the use of macro diversity combination produces a degree of ambiguity of the location of a mobile station.

Further, the mobile station does not necessarily know the location area and the routing area of the cells in the active set, if the network does not indicate the system information of each cell at the time, when the cell is added to the active set. This creates a problem in such a situation, when a mobile station has active connections to one core network element e.g. MSC, and none to another core network element such as the SGSN, in which case the packet data entities are in idle state. In idle state, the MS should perform location updates regularly, or when the MS moves into another routing or location area. However, when the mobile station does not know the location and routing areas of the cells, the determination of whether a location update should be performed poses a further problem.

SUMMARY OF THE INVENTION

An object of the invention is to realise a location management method, which alleviates the previously described problems of the prior art.

The objects are reached by assigning priority levels to the cells of the active set of a macro diversity connection. There can be two or more different priority levels. A two-level priority scheme can be realised by further classifying the cells in the active set as being in a serving cell set or outside of the serving cell set. The serving cell set comprises cells, which are in the active set and which are under control of the serving RNC. One of the cells of the serving cell set is selected to be a master cell, which defines the location of the mobile station. More than two priority levels can also be used.

The method according to the invention is characterised by that, which is specified in the characterising part of the independent method claim. The mobile communication means according to the invention is characterised by that, which is specified in the characterising part of the independent claim directed to a mobile communication means. The system according to the invention is characterised by that, which is specified in the characterising part of the independent claim directed to a system. The dependent claims describe further advantageous embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is described in more detail in the following with reference to the accompanying drawings, of which

Figure 1 illustrates a problem of the prior art,

Figure 2 is used to illustrate an advantageous embodiment of the invention,

Figure 3 is used to illustrate a further advantageous embodiment of the invention,

Figure 4 illustrates a mobile station according to an advantageous embodiment of the invention, and

Figure 5 illustrates a system according to an advantageous embodiment of the invention.

Same reference numerals are used for similar entities in the figures.

DETAILED DESCRIPTION

1. CELL PRIORITIES

According to the invention, priority levels are assigned to the cells of the active set of a macro diversity connection. The priority levels can comprise for example two distinct priority levels, i.e. prioritised and non-prioritised cells. The priority levels may be assigned for example according to certain localised services provided within a certain area in the network, or for example on routing and/or location areas of the cells. As a further example, the prioritised cells can be those cells of the active set which are under control of the serving RNC, and the non-prioritised cells can be those cells which are under control of another RNC.

2. SERVING CELL SET

According an advantageous embodiment of the invention, the prioritisation is realised by defining a serving cell set within the active set. The serving cell set is the set of cells, which belong to the active set and are under control of the serving RNC. Since the active set may comprise one cell or a plurality of cells, and since the serving RNC controls at least one cell in the active set, the serving cell set may cover the whole active set or form a subset of the active set.

The MS can use any cells that belong to the serving cell set for various network activities such as location registration or mobile originated (MO) connection management (CM) service requests, and for example for paging responses through the RRC connection when the terminal already has active connections to a core network element.

3. UPDATING OF THE SERVING CELL SET

When the SRNC adds new cells to the active set, it indicates to the MS whether the new cell is under control of the SRNC or not, i.e. whether the new cell belongs to the serving cell set. This indication may be advantageously added to the ACTIVE SET UPDATE message of the RRC (Radio Resource Control) protocol active between the MS and the SRNC, for example as a new parameter. Consequently, the serving cell set at the MS is maintained up to date. However, the invention is not limited to using the RRC ACTIVE SET UPDATE message, since the indication of the new cell being in the serving cell set may be communicated to the MS using

other messages as well. For example, a new message can be defined for that purpose.

The serving cell set is advantageously stored in a memory element in the MS, for example as a list or a table. A man skilled in the art knows many different ways of storing sets of information in digital memory elements, wherefore storing of sets of information is not described further in this specification.

Updating of the serving cell set is described in a further example according to figure 2. Figure 2 shows a mobile station 100 having a macro diversity connection through base stations BS2, BS3, and BS4 105. Base stations BS2 and BS3 are under control of radio network controller RNC1 110, while base station BS4 is under control of RNC2 110. The dashed arrows in figure 2 indicate the flow of signals in the radio access network, illustrating that RNC1 is the serving RNC in this example. Figure 2 further shows a MSC 115 and a SGSN 120 connected to the radio network controllers. In the example of figure 2, base stations BS2, BS3, and BS4 constitute the active set. Other base stations shown in figure 2 are not used and therefore do not belong to the active set. Base stations BS2 and BS3 belong to the serving cell set, since they are under control of the SRNC. In the case that the serving RNC wishes to add for example the base station BS1 to the active set, the network would send the RRC ACTIVE SET UPDATE message to inform the MS about the addition to the active set, and indicate that the cell of base station BS1 does belong to the serving cell set. In the case that the serving RNC wishes to add for example the base station BS5 to the active set, the network would send the RRC ACTIVE SET UPDATE message to inform the MS about the addition to the active set. In this case the network may explicitly indicate that the cell of base station BS5 does not belong to the serving cell set, or give the indication implicitly by not giving any indication of whether the cell of BS5 belongs to the serving cell set or not, whereby the MS can assume as a default that the cell of BS5 does not belong to the serving cell set.

4. MASTER CELL

Preferably, one of the cells of the serving cell set is selected to be a master cell, or in other words, a current serving cell. The master cell can subsequently be used as a definition of the location of the mobile station for example in location updating and CM service request procedures, and can be specified in a RANAP (Radio Access Network Application Part) COMPLETE LAYER 3 message as the location of the

MS. The selection of a master cell has for example the advantage that it removes the location ambiguity introduced by macro diversity connections. The master cell can be selected in a wide variety of ways, some of which are described as examples below. However, the following embodiments are examples only, and do not limit the invention in any way.

However, the invention is not limited to using the COMPLETE LAYER 3 message, since the indication of the new cell being in the serving cell set may be communicated to the MS using other messages as well. For example, a new message can be defined for that purpose.

The MS can use the master cell for various network activities such as location registration or mobile originated (MO) connection management (CM) service requests, and for example for paging responses through the RRC connection when the terminal already has active connections to a core network element.

4.1 MASTER CELL SELECTION: A FIRST EXAMPLE

According to an advantageous embodiment of the invention, the master cell is selected according to a predefined rule. This embodiment has the advantage, that the master cell information does not need to be communicated either from the network to the mobile station or from the mobile station to the network, since both the network and the mobile station follow the same rule. At the network side, the selection of the master cell according to a predefined rule is preferably performed by the SRNC.

Many different types of rules can be used in various embodiments of the invention. For example, the master cell could be selected to be the cell, which has been in the active set for the longest time and is under control of the SRNC. In this embodiment, the network and the mobile station can for example record the times when a cell is added to the active set in order to determine how long a cell has been in the active set. Another way to realize such a rule is to use a queue. In such an embodiment, a cell which is added to the active set is placed at the end of the queue. If a cell is removed from the active set, it is also removed from the queue. The first cell in the queue being in the serving cell set is consequently the cell, which has been in the active set for the longest time and which is under control of the SRNC. In case the master cell is removed from the active set, a new master cell is chosen according to the rule.

The SRNC may also indicate the selected master cell to the MS in an explicit message, for example for guaranteeing that the MS and the SNRC have chosen the same cell to be the master cell.

4.2 MASTER CELL SELECTION: A SECOND EXAMPLE

In a further advantageous embodiment of the invention, the mobile station proposes which cell of the serving cell set should be the master cell. The mobile station may advantageously indicate the desired cell for example in a location update request, a CN domain service request, or a paging response message. The indication may be included for example in a RRC level data message. This embodiment has the advantage, that the MS has the possibility to propose a master cell, if the MS has good reasons for doing so. The SRNC does not always know the most suitable cell which should be used for the MS if reasons outside the scope of control of the SRNC affect the usefulness of a certain cell.

For example, the mobile station may have a list of home cells, which should be used if possible. The home cells may have some special advantage, such as a lower billing rate, higher allowed transmission rates, or some other special services arranged by the local operator. The list of home cells may be stored for example in the USIM (UMTS Subscriber Identity Module) of the mobile station. If one or more of the home cells belongs to the serving cell set, it is advantageous if one of these cells is chosen as the master cell.

As a further example, the cellular network may have localized services, in which certain services are provided within predefined service areas, for example within a certain cell or a group of cells. The services can for example be transmission of SMS (Short Message Service) messages to mobile stations within a certain area, such as advertising messages to mobile stations within a shopping centre. The services can for example comprise cheaper billing rates and higher transmission rates at special locations, such as within or near corporate premises. Such services are known at least as Localized Cellular Services (LCS). Typically, the mobile station has information stored in the SIM (Subscriber Identity Module) of the MS about the localized services and the cells where the services are provided, in which case the MS may advantageously use that information in the selection of a master cell.

If the SRNC receives a proposal of the serving cell from the MS, SRNC adds an indication of the cell proposed by the MS to the RANMAP COMPLETE LAYER 3 information message. Preferably, the SRNC checks if the proposed cell belongs to the active set of the MS and it is controlled by the SRNC i.e. if the cell belongs to the serving cell set. If MS proposes a cell which is not in the serving cell set, the SRNC can choose the master cell for example according to a predefined rule.

The proposing of a master cell according to an advantageous embodiment of the invention is illustrated further in the following with reference to figure 3. Figure 3 shows a mobile station 100 having a macro diversity connection through base stations BS2 and BS3. Base stations BS2 and BS3 are under control of radio network controller RNC1 110, which is also the serving RNC in this example. Figure 2 further shows a MSC 115 and a SGSN 120 connected to RNC1.

In figure 3, the MS has e.g. a packet data connection to SGSN1 and is registered as being in location area LA1. The MS performs for example a location update by sending a LOCATION UPDATE REQUEST message to the network, for example to the MSC, which does not have active connections to the MS in this example. Attached to the message, the MS transmits the identification of the desired cell, i.e. the identifier of the cell of base station BS3. As a result, the MS is registered in the network as being located in the location area LA2 in the cell of BS3. Without the proposal of the MS, the RNC would receive the location update request from two base stations, and would need to choose the master cell by itself, for example according to a predefined rule as described previously.

The MS may send a LOCATION UPDATE REQUEST message also to a core network element, which has active connections to the MS. For example, if a MS has active packet connections to a SGSN, the MS may nevertheless send a LOCATION UPDATE REQUEST message, for example in case the MS observes that it has moved to a new routing area.

As described previously, the location update request is only an example of a situation, when a MS may propose a desired master cell. The MS may propose a cell also for example when requesting CN domain service, for example when requesting a new connection. In the example of figure 3, the MS may send a message to the MSC1 for initiating a speech connection, and indicate the desired master cell for example in a parameter attached to the message. The message may in this example be for example a SETUP message, a CM SERVICE REQUEST

message, a PAGING RESPONSE message or some other message for initiating a speech connection.

5. EFFECT OF SRNC RELOCATION

The SRNC relocation adds extra complexity to the location management of the MS when the MS is active. In SRNC relocation, the status and duties of serving RNC is transferred from one RNC to another. In an advantageous embodiment of the invention, the priority levels of the cells in the active set are changed as a response to serving RNC relocation. Serving RNC relocation is described further for example in the Finnish patent application FI 980736.

In such an embodiment, where the prioritisation is realised by defining a serving cell set, the serving cell set needs to be changed after the SRNC relocation. This can be triggered for example by notifying the MS after SRNC relocation. For example, the new SRNC may perform the notification, as a result of which the MS updates the serving cell set to reflect the relocation of the serving RNC. The notification may be realised for example by sending a predefined message such as a SRNC RELOCATION NOTIFICATION message. After the updating of the serving cell set, one cell of the serving cell set is selected to be the master cell for example according to any of the previously described embodiments. In the following, some examples are presented of how the updating of the serving cell set is realised after a SRNC relocation.

5.1 A FIRST EXAMPLE

According to an advantageous embodiment of the invention, the updating of the serving cell set proceeds as follows in a situation, in which two radio network controllers participate in the macro diversity communication. After the RNC relocation signalling between for transferring the serving RNC status from a first RNC to a second RNC is finished, the second RNC sends an indication to the MS, indicating that the second RNC is now the serving RNC. As a response to receiving the indication, the mobile station examines the active set and for each cell in the active set, changes the information indicating whether the cell is in the serving cell set or not. If a cell is indicated as being a part of the serving cell set, the indication is changed to indicate that the cell is outside the serving cell set. If a cell is indicated as being outside the serving cell set, the indication is changed to indicate that the cell is in the serving cell set. In other words, those cells which are under control of

the old serving RNC are marked as being outside the serving cell set and cells under control of the new serving RNC are marked as being in the serving cell set.

5.2 A SECOND EXAMPLE

The previous example can not be used in a situation, in which more than two radio network controllers participate in the macro diversity communication, since the serving cell set comprises cells under control of only one RNC, and the rest of the active set comprises cells under control of more than one RNC. According to a further advantageous embodiment of the invention, the new serving RNC includes information about cells into the message informing the MS about the serving RNC relocation, i.e. information based on which the MS can deduce, which cells are in the serving cell set and which are not. Preferably, the information about cells comprises at least a list of cell identifiers of those cells, which are in the active set and are under control of the new serving RNC. The information about cells may also comprise a list of all cells under control of the new serving RNC, whereby the MS can compare the received list and the active set to determine the serving cell set.

This embodiment has the advantage, that it does not require many changes to the existing procedures. A further possibility would be to add a RNC identification to the cell identification information, whereby the mobile stations would always know which cells are under control of a given RNC. The serving cell set would then be the common subset of the active set and the set of all cells under control of the serving RNC, and the updating of the serving cell set could be performed simply on the basis of the RNC identification of the new serving RNC. However, such an approach would require quite a lot of changes to the existing procedures.

6. LOCATION UPDATING

One possible solution to the previously described problem of when to perform location updating is to implement a multicode capability into the receiver, i.e. arrange the receiver in such a way that it can receive from more than one transmitter simultaneously, which would allow the receiver to monitor the BCCH channel, in which system information messages are transmitted by the network. Another solution would be to arrange the receiver to perform slotted mode reception, which would allow the receiving of system information messages during gaps created by the slotted mode reception. However, these solutions result in complicated receiver

structures, increasing the manufacturing cost of the mobile stations. A less complicated solution is needed.

According to an advantageous embodiment of the invention, a location information request procedure is used to obtain the location information, i.e. information about the current serving cell set. According to the embodiment, the mobile station may request the SRNC to send a system information message over the RRC connection active between the MS and the network. This embodiment allows the utilisation of the RRC connection which is already active due to the connection between the MS and e.g. the MSC, removing the need for the packet entities in the MS to monitor BCCH channels in the hope of receiving a system information message. The system information message sent over the RRC connection may have the same format which is used on the BCCH channels, or a specific format may be defined for this purpose.

In a further advantageous embodiment of the invention, the SRNC may send the system information of the master cell even without explicit request from the mobile station. For example, the SRNC may send the system information of the master cell after sending some other message to the MS.

In another advantageous embodiment of the invention, the mobile station monitors changes in the serving cell set for deciding about when to perform location updating. Events, which may trigger the sending of a location update request by the mobile station may be for example any one of the following:

- SRNC relocation,
- change of master cell for example according to any of the previously described embodiments, especially for the packet data domain of the core network when the new master cell is within a different routing area as the previous master cell, or for example
- when the last cell of those cells which were in the serving cell set at the time of the previous location update is removed from the active set.

However, the previous list of events is an example only and do not limit the invention in any way. Other events may also be used for triggering the location update procedure.

In a further advantageous embodiment of the invention, the mobile station uses the location information request procedure at least partly for deciding about which cell

should be the master cell. The location information request procedure may in this embodiment be performed for example as described previously.

7. AN EXAMPLE OF A MOBILE STATION

Figure 4 shows a block diagram of a digital mobile station, more generally a mobile communication means according to an advantageous embodiment of the invention. The mobile communication means comprises a microphone 301, keyboard 307, display 306, earpiece 314, antenna duplexer or switch 308, antenna 309 and a control unit 305, which all are typical components of conventional mobile communication means. Further, the mobile communication means contains typical transmission and receiver blocks 304, 311. Transmission block 304 comprises functionality necessary for speech and channel coding, encryption, and modulation, and the necessary RF circuitry for amplification of the signal for transmission. Receiver block 311 comprises the necessary amplifier circuits and functionality necessary for demodulating and decryption of the signal, and removing channel and speech coding. The signal produced by the microphone 301 is amplified in the amplifier stage 302 and converted to digital form in the A/D converter 303, whereafter the signal is taken to the transmitter block 304. The transmitter block encodes the digital signal and produces the modulated and amplified RF-signal, whereafter the RF signal is taken to the antenna 309 via the duplexer or switch 308. The receiver block 311 demodulates the received signal and removes the encryption and channel coding. The resulting speech signal is converted to analog form in the D/A converter 312, the output signal of which is amplified in the amplifier stage 313, whereafter the amplified signal is taken to the earpiece 314. The control unit 305 controls the functions of the mobile communication means, reads the commands given by the user via the keypad 307 and displays messages to the user via the display 307. The mobile station is able to communicate with the network using macro diversity connections, i.e. has means 305,304,308,309,311 for communicating with the network using macro diversity connections. The mobile station further comprises receiving means 320 for receiving information for construction of a priority order for the plurality of cells, and selecting means 321 for selecting a master cell at least partly on the basis of said priority order. Preferably the mobile station further comprises means 322 for indicating the selected master cell to the network. Preferably the receiving means 320 for receiving information for construction of a priority order, the selecting means, and the means for indicating are realised using software programs stored in a memory element of the control unit 305 and executed by a microprocessor of the control unit 305.

8. AN EXAMPLE OF A SYSTEM

Fig. 5 shows a block diagram of a cellular telecommunication system. The core network of a cellular radio system comprises mobile services switching centres (MSC), other network elements (in GSM, e.g. SGSN and GGSN, i.e. Serving GPRS Support Node and Gateway GPRS Support node, where GPRS stands for General Packet Radio Service) and the related transmission systems. In Fig. 5, the core network of a cellular telecommunication system 930 comprises a core network CN 931 which has three parallel radio access networks linked to it. Of those, networks 932 and 933 are UMTS radio access networks and network 934 is a GSM radio access network. The upper UMTS radio access network 932 is e.g. a commercial radio access network, owned by a telecommunications operator offering mobile services, which equally serves all subscribers of said telecommunications operator. The lower UMTS radio access network 933 is e.g. private and owned e.g. by a company in whose premises said radio access network operates. Typically the cells of the private radio access network 933 are nano- and/or picocells in which only terminals of the employees of said company can operate. All three radio access networks may have cells of different sizes offering different types of services. Additionally, cells of all three radio access networks 932, 933 and 934 may overlap either entirely or in part.

The terminal 10 shown in Fig. 5 is preferably a so-called dual-mode terminal that can serve either as a second-generation GSM terminal or as a third-generation UMTS terminal according to what kind of services are available at each particular location and what the user's communication needs are. It may also be a multimode terminal that can function as terminal of several different communications systems according to need and the services available. Radio access networks and services available to the user are specified in a subscriber identity module 936 (SIM) connected to the terminal.

Figure 5 further shows some details of the structure of a radio access network. A radio access network 932, 934 typically comprises one or more base stations 937 and a controlling unit 42. In UMTS radio access networks 932, 933 the controlling unit is called the radio network controller (RNC), and in GSM networks 934 the controlling unit is called a base station controller (BSC). The radio access networks typically comprise also other network elements such as transcoder units. Figure 5 further shows a mobile services switching centres (MSC) 43 which basically

controls circuit-switched connections of mobile stations 10 and a Serving GPRS Support Node (SGSN) 41 which basically controls packet switched connections of mobile stations 10.

According to the invention, the cellular telecommunication system 20 comprises a system 200, which is arranged to receive information specifying a master cell from a mobile station, and to indicate the specified cell as the location of the mobile station to the core network of the cellular telecommunication system. Preferably, the system 200 is located in a radio access network 932 of the cellular telecommunication system. The system may advantageously be located in the radio network controller 42 of the radio access network 932. The system 200 may advantageously be realised using software programs stored in a memory element of the control unit of the radio network controller and executed by a processor unit of the control unit of the radio network controller. However, the system 200 may also be realised in a separate network element, such as a macro diversity combiner (MDC) unit. Further, in such an embodiment in which the macro diversity combining is performed in a MDC which is realised as a separate network element from the radio network controller, the functions of the system 200 may be implemented partly in the RNC and partly in the MDC. The MDC unit or the corresponding functionality may also be realised within the RNC, in which case the RNC performs the macro diversity combining and preferably comprises the system 200.

9. FURTHER CONSIDERATIONS

The invention may advantageously be used in third generation cellular systems such as the UMTS cellular telecommunication system. However, the invention may also be used in other cellular systems.

The name of a given functional entity, such as the radio network controller, is often different in the context of different cellular telecommunication systems. For example, in the GSM system the functional entity corresponding to a radio network (RNC) is the base station controller (BSC). Therefore, the term radio network controller in the claims is intended to cover all corresponding functional entities regardless of the term used for the entity in the particular cellular telecommunication system. Further, the various message names such as the ACTIVE SET UPDATE message name are intended to be examples only, and the invention is not limited to using the message names recited in this specification.

In view of the foregoing description it will be evident to a person skilled in the art that various modifications may be made within the scope of the invention. While a preferred embodiment of the invention has been described in detail, it should be apparent that many modifications and variations thereto are possible, all of which fall within the true spirit and scope of the invention.

Claims

1. A method for location control in a cellular telecommunication system supporting macro diversity connections, **characterised** in that
priority levels are assigned to the cells of the active set of a macro diversity connection, and
the location of a mobile station is determined at least partly based on said priority levels.

2. A method according to claim 1, **characterised** in that
each of the cells used in a macro diversity connection between a mobile station and the network is classified as being in a serving cell set or outside said serving cell set.

3. A method according to claim 2, **characterised** in that
one of the cells in the serving cell set is selected to be a master cell.

4. A method according to claim 3, **characterised** in that
said selection is performed by the network.

5. A method according to claim 4, **characterised** in that
the network performs the selection of the master cell as a response to a message received from the mobile station, which message does not contain an indication of a master cell.

6. A method according to claim 3, **characterised** in that
said selection is performed according to a predefined rule.

7. A method according to claim 6, **characterised** in that
the cell of the serving cell set which has been in the active set for the longest time is selected to be the master cell.

8. A method according to claim 3, **characterised** in that
said selection is performed by the mobile station.

9. A method according to claim 8, **characterised** in that
the cell selected by the mobile station is indicated to the network in a message sent by the mobile station.

10. A method according to claim 8, **characterised** in that
- the mobile station requests location information from the network,
- the mobile station receives a response to the request from the network, and
- the selection of the master cell is performed at least partly based on said response.

11. A method according to claim 8, **characterised** in that
said selection is performed at least partly on the basis of information about localised services of the network stored in the mobile station.

12. A method according to claim 1, **characterised** in that
the priority levels of the cells in the active set are changed as a response to serving RNC relocation.

13. A method according to claim 2, **characterised** in that
as a response to serving RNC relocation, the cells of the active set which were designated as being in the serving cell set are designated as being outside the serving cell set, and the cells of the active set which were designated as being outside the serving cell set are designated as being in the serving cell set.

14. A method according to claim 2, **characterised** in that
the mobile station designates those cells of the active set as being in the serving cell set, which cells are listed in a message received from the network informing the mobile station about a serving RNC relocation, and designates other cells of the active set as being outside the serving cell set.

15. A method according to claim 2 used in a cellular telecommunication system comprising a first network element for controlling circuit switched connections and a second network element for controlling packet switched connections, **characterised** in that
when a mobile station has an active connection to a first of the first and second network elements and no active connections to a second of the first and second network elements,
a location update to said second of the first and second network elements is performed at least partly as a response to a change in said serving cell set.

16. A method according to claim 15, **characterised** in that
said location update is performed at least partly as a response to the changing of all cells in the serving cell set.

17. A method according to claim 15, **characterised** in that
said location updates are performed at least partly as a response to removing of the last of those cells in the serving cell set, which cells were in the serving cell set when a location update was performed the previous time.

18. A method according to claim 15, **characterised** in that
the method comprises steps, in which
- the mobile station requests location information from the network,
- the mobile station receives a response to the request from the network, and
- the mobile station makes a decision about whether or not to perform a location update to said second of the first and second network elements at least partly based on said response.

19. A method according to claim 2 used in a cellular telecommunication system comprising a first network element for controlling circuit switched connections and a second network element for controlling packet switched connections, **characterised** in that
when a mobile station has an active connection to a first of the first and second network elements and no active connections to a second of the first and second network elements, a location update to said first of the first and second network elements is performed at least partly as a response to a change in said serving cell set.

20. A mobile station for a cellular telecommunication system comprising a cellular network, which mobile station has means for communicating using macro diversity connections in which the mobile station communicates with the cellular network via a plurality of cells, **characterised** in that the mobile station comprises
receiving means for receiving information for construction of a priority order for the plurality of cells, and selecting means for selecting a master cell at least partly on the basis of said priority order.

21. A mobile station according to claim 20, **characterised** in that
the mobile station further comprises means for indicating the selected master cell to the network.

22. A system in a cellular telecommunication system, **characterised** in that the system is arranged to receive information specifying a master cell from a mobile station, and to indicate the specified cell as the location of the mobile station to the core network of the cellular telecommunication system.

23. A system according to claim 22, **characterised** in that the system is located in a radio access network of the cellular telecommunication system.

24. A system according to claim 23, **characterised** in that the system is located in the radio network controller of said radio access network.

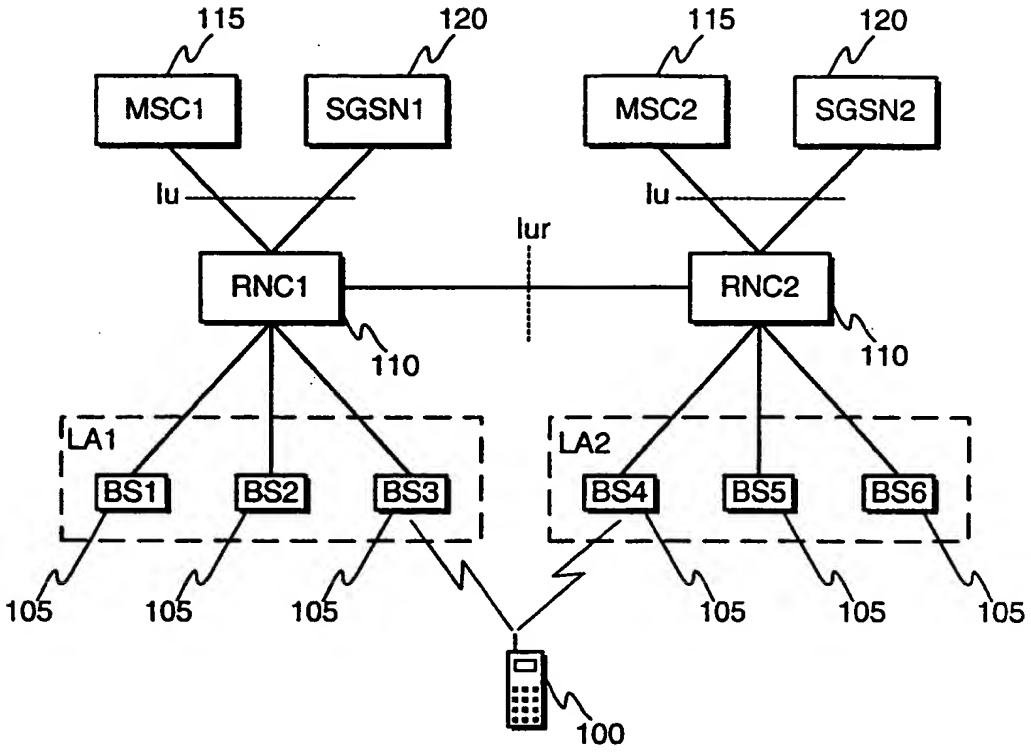
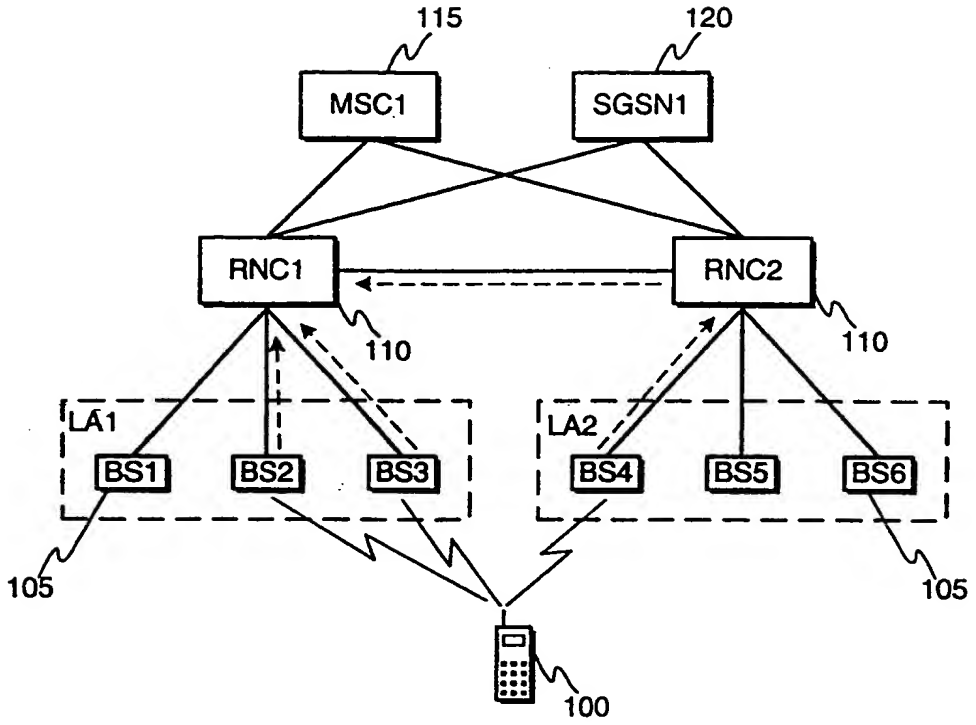


Fig. 1
PRIOR ART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SGSN1
RNC1
RNC2
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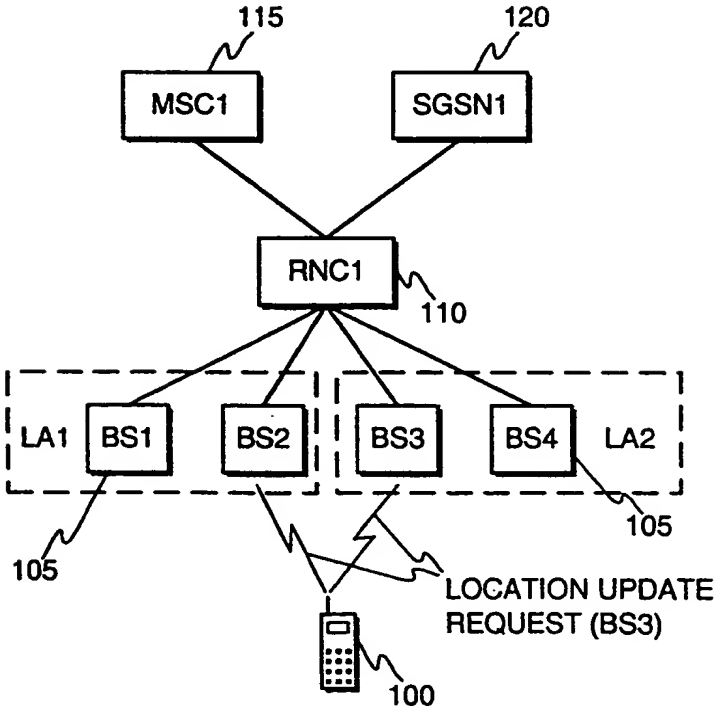
110
LA1
LA2
BS1
BS2
BS3
BS4
BS5
BS6
105
105
100

Fig. 2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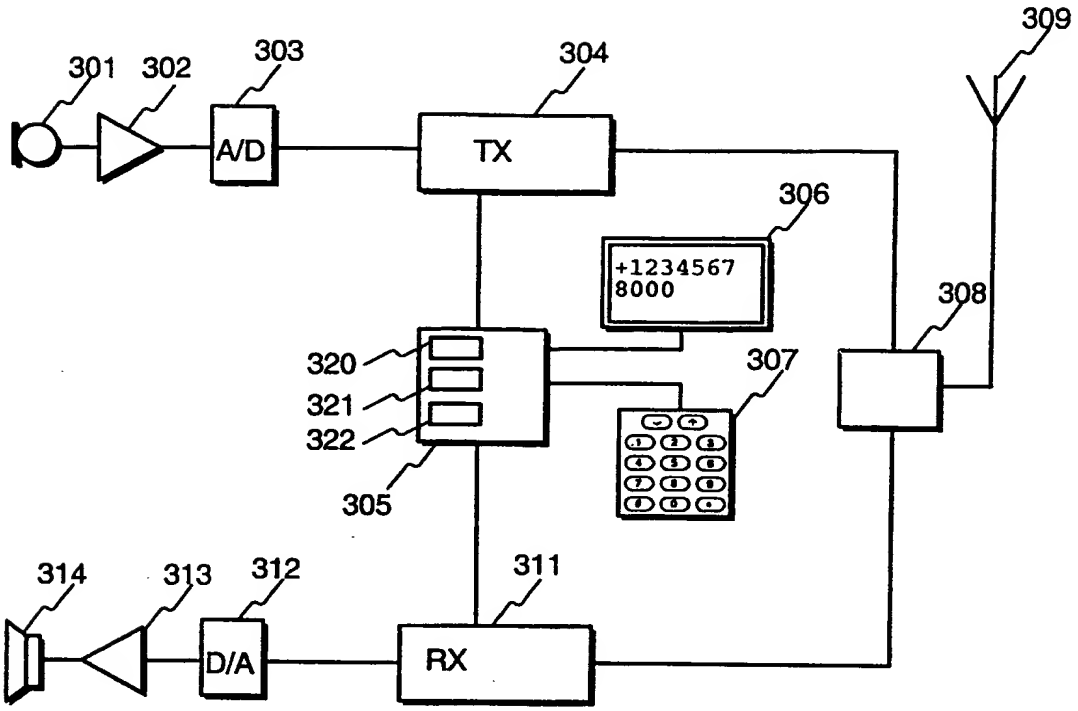
120
MSC1
SGSN1
RNC1
110
LA1
BS1
BS2
BS3
BS4
LA2
105
105
LOCATION UPDATE
REQUEST (BS3)
100

Fig. 3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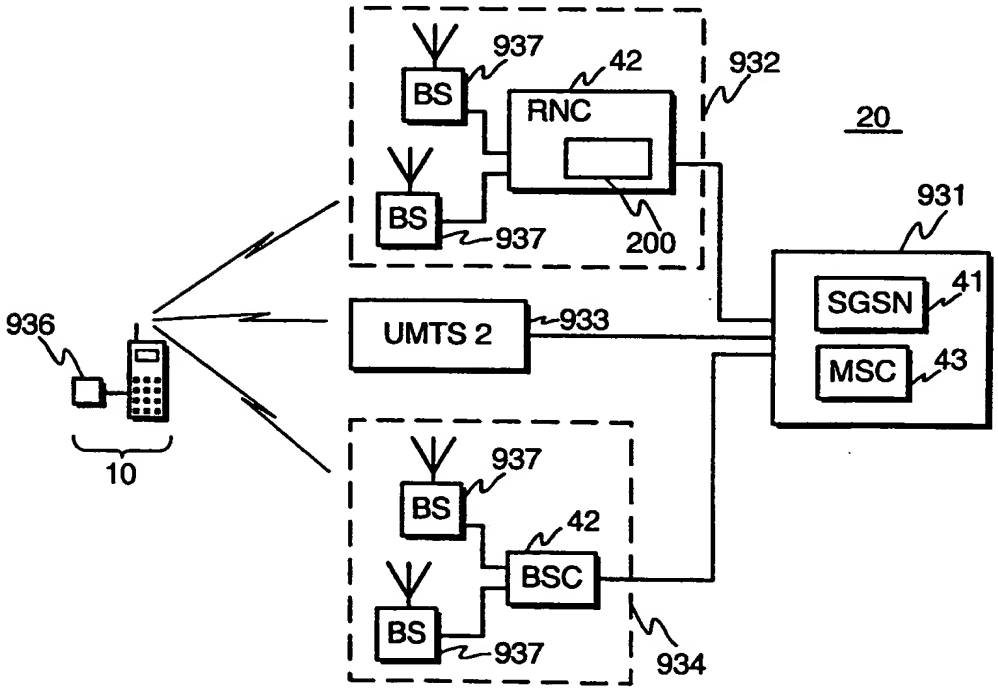
313
312
311
D/A
RX

Fig.4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RNC
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BS
937
200
931
936
UMTS 2
933
SGSN
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MSC
43
10
937
BS
42
BSC
BS
937
934

Fig. 5